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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/669,135	09/23/2003	Milan Kokta	1035-BI4307	2824

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EXAMINER	
SONG, MATTHEW J	

ART UNIT	PAPER NUMBER
1722	

DATE MAILED: 12/14/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/669,135	KOKTA ET AL.	
	Examiner	Art Unit	
	Matthew J. Song	1722	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07 November 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-5,11-16,19-26 and 31* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5,11-16,19-26 and 31* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *11/7/05;9/22/05*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

2. Claims 1-5, 11-16, 19-20, 22-26 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schmid (US 3,898,051) in view of Robinson et al (US 3,808,065).

In a method of growing single crystals, note entire reference, Schmid discloses a single crystal is grown by melting a material in a crucible and solidifying the melted material (Abstract). Schmid also discloses growing spinel crystals (col 1, ln 1-15). Schmid also discloses growing stoichiometric $MgAl_2O_4$ spinel single crystals (col 9, ln 5-20). Schmid also discloses after solidification a single crystal boule **104** is cooled to room temperature at a rate of about 50°C per hour after annealing for a few hours (col 5, ln 55-68 and col 6, ln 50 to col 7, ln 15).

Schmid also discloses the crystal is grown to be approximately equal to the diameter of crucible (Fig 3d).

Schmid does not disclose slicing the boule into a plurality of wafers

In a method of manufacturing spinel wafers, note entire reference, Robinson et al teaches single crystal spinel boules are sliced into wafers with a diamond saw. Robinson et al also teaches spinel wafers with smooth surfaces are useful as substrates in the electric integrated circuit art (col 1, ln 1-35).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Schmid by slicing the single crystal spinel boule into wafers, as taught by Robinson et al, to form substrates useful in the electronic integrated circuit art.

Referring to claims 1-4, the combination of Schmid and Robinson et al teaches a batch melt in a crucible; growing a spinel boule from the melt ('051 col 9, ln 1-20 and col 5, ln 60-68); annealing for a few hours ('051 col 7, ln 1-15), this reads on applicant's annealing is restricted to a time period not greater than about 10 hours because few is a term used to represent a small number; and slicing the boule into wafers ('065 col 1, ln 1-35).

Referring to claim 5, the combination of Schmid and Robinson et al teaches annealing for a few hours. This can read on substantially completely eliminated because the annealing period has been substantially eliminated from the conventional annealing time of 300 hrs.

Referring to claims 6-8, 17-19, and 27-29, the combination of Schmid and Robinson et al teaches forming stoichiometric $MgAlO_4$. The combination of Schmid and Robinson et al does not teach forming a non-stoichiometric spinel. Changes in concentration are held to *prima facia*

obvious (MPEP 2144.05) and non-stoichiometric spinel crystals are known in the art, as evidenced by Grabmaier et al ("Czochralski Growth of Magnesium-Aluminum Spinel") below.

Referring to claims 9, 22 and 30, the combination of Schmid and Robinson et al teaches forming a single crystal by cooling a melt using a temperature gradient ('051 col 5, ln 25-55), this reads on applicant's Bridgman method.

Referring to claim 10-15, the combination of Schmid and Robinson et al teaches forming a crystal with a diameter approximately equal to the diameter of the crucible, which is approximately an aspect ratio of 1.

Referring to claim 16, the combination of Schmid and Robinson et al does not teach the process aspect ratio is effective to prevent flipping of the boule from a [111] orientation to a different orientation. The combination of Schmid and Robinson et al teaches a process aspect ratio within the claimed range; therefore the ratio taught by the combination of Schmid and Robinson et al inherently prevent flipping because the ratio is within the range of ratios taught by applicant's to prevent flipping.

Referring to claim 24-26, the combination of Schmid and Robinson et al teaches cooling to room temperature at a rate of approximately 50°C/hr ('051). The combination of Schmid and Robinson et al does not teach cooling at a rate not less than 100°C/hr, 200°C/hr or 300°C/hr. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Schmid and Robinson et al by cooling at the claimed rate to increase productivity by reducing the time required to cool the boule.

Referring to claim 31, the combination of Schmid and Robinson et al teaches a batch melt in a crucible; growing a spinel boule from the melt which has a diameter approximately equal to

the diameter of the crucible ('051 col 9, ln 1-20 and col 5, ln 60-68 and Fig 3d); annealing for a few hours ('051 col 7, ln 1-15), this reads on applicant's annealing is restricted to a time period not greater than about 10 hours because few is a term used to represent a small number; and slicing the boule into wafers ('065 col 1, ln 1-35).

3. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Schmid (US 3,898,051) in view of Robinson et al (US 3,808,065) as applied to claim 1 above, and further in view of Grabmaier et al ("Czochralski Growth of Magnesium-Aluminum Spinel").

The combination of Schmid and Robinson et al teaches annealing for a few hours. The combination of Schmid and Robinson et al does not explicitly teach annealing is substantially completely eliminated.

Grabmaier et al teaches growing stoichiometric Mg-Al spinel and a crystal with a molar ratio of Mg):Al_2O_3=1:3.2. Grabmaier et al also teaches using a Czochralski method to grow the crystal, this reads on applicant's boule, using a seed crystal, a melt contained in an iridium crucible and a pulling rate of 0.5 cm/hr. Grabmaier et al also teaches the crystal could be sawed unannealed without cracking (pg 355-356), this reads on applicant's annealing time period not greater than 50 hours because the annealing time is 0.

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Schmid and Robinson et al by eliminating or reducing the time of the annealing step, as taught by Grabmaier et al to increase productivity.

4. Claims 23-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Giess et al ("Growth of Single Crystal $MgGa_2O_4$ Spinel") in view of Robinson et al (US 3,808,065).

In a method of growing spinel crystals, note entire reference, Giess et al discloses a method of growing large single crystal boules of a $MgGa_2O_4$ Spinel using the Czochralski pulling method and a melt within an iridium crucible, this reads on applicant's batch melt in a crucible. Giess et al also discloses the crystal is slowly cooled from the growth temperature of 1950+100°C to room temperature over a period of 16 hours (pg 151-152 and Figure). The rate can be determined to be approximately 128°C/hr.

Giess et al does not disclose slicing the boule into a plurality of wafers.

In a method of manufacturing spinel wafers, note entire reference, Robinson et al teaches single crystal spinel boules are sliced into wafers with a diamond saw. Robinson et al also teaches spinel wafers with smooth surfaces are useful as substrates in the electric integrated circuit art (col 1, ln 1-35).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Giess et al by slicing the single crystal spinel boule into wafers, as taught by Robinson et al, to form substrates useful in the electronic integrated circuit art.

Referring to claims 23-24, the combination of Giess et al and Robinson et al teaches a rate of approximately 128°C/hr is within the claimed cooling rate range.

Referring to claim 25-26, the combination of Giess et al and Robinson et al does not teach cooling at a rate not less than 200°C/hr or 300°C/hr. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Giess

et al and Robinson et al by cooling at the claimed rate to increase productivity by reducing the time required to cool the boule.

5. Claims 11-16, 19-20 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wyon et al ("Czochralski growth and optical properties of magnesium-aluminum spinel doped with nickel") in view of Robinson et al (US 3,808,065).

In a method of growing spinel single crystals, note entire reference, Wyon et al discloses $MgAl_2O_4$ crystal doped with nickel ($Mg_{1-x}Ni_xAl_2O_4$) are pulled from a melt contained in a crucible. Wyon et al also discloses a crucible diameter of 60 mm and crystals with a diameter of 25 mm (pg 710-711). The process aspect ratio can be determined to be 0.4166. Wyon et al also discloses the preferential growth axis is <111> (pg 711). Wyon et al discloses boules (pg 712).

Wyon et al does not disclose slicing the boule into a plurality of wafers.

In a method of manufacturing spinel wafers, note entire reference, Robinson et al teaches single crystal spinel boules are sliced into wafers with a diamond saw. Robinson et al also teaches spinel wafers with smooth surfaces are useful as substrates in the electric integrated circuit art (col 1, ln 1-35).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Wyon et al by slicing the single crystal spinel boule into wafers, as taught by Robinson et al, to form substrates useful in the electronic integrated circuit art.

Referring to claim 13, the combination of Wyon et al and Robinson et al teach a ratio of 0.416, this reads on applicant's about 0.42 because using conventional rounding techniques to round 0.416 to two significant digits results in 0.42.

Referring to claim 14-15, the combination of Wyon et al and Robinson et al teach a ratio of 0.416. The combination of Wyon et al and Robinson et al does not teach a ratio not less than about 0.43 or 0.44. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Wyon et al and Robinson et al to have a process aspect ratio within the claimed range by increasing the size of the boule because larger boules are desirable in the art. Furthermore, a prima facia case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties (MPEP 2144.05).

Referring to claim 16, the combination of Wyon et al and Robinson et al does not teach the process aspect ratio is effective to prevent flipping of the boule from a [111] orientation to a different orientation. The combination of Wyon et al and Robinson et al teaches a process aspect ratio within the claimed range; therefore the ratio taught by the combination of Wyon et al and Robinson et al inherently prevent flipping because the ratio is within the range of ratios taught by applicant's to prevent flipping.

Referring to claim 19, the combination of Wyon et al and Robinson et al teaches a $Mg_{1-x}Ni_xAl_2O_4$ crystal, this reads on applicant's no stoichmetric crystal.

Referring to claim 20, the combination of Wyon et al and Robinson et al teaches crystals pulled by seeding from an iridium wire, this reads on applicant' seed crystal.

Referring to claim 22, the combination of Wyon et al and Robinson et al teaches a Czochralski technique.

6. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wyon et al ("Czochralski growth and optical properties of magnesium-aluminum spinel doped with nickel") in view of Robinson et al (US 3,808,065) as applied to claims 11-20 and 22 above, and further in view of Li (US 5,968,267).

The combination of Wyon et al and Robinson et al teach all of the limitations of claim 21, as discussed previously, except rotating the seed crystal.

In a Czochralski method of crystal growth, note entire reference, Li teaches its is common practice is a Czochralski process to rotate the seed about its longitudinal axis during the pulling process in order to grow a crystal with a more uniform cross section and the crucible holding the melt may also be rotated to grow a crystal with a more uniform cross section (col 2, ln 35-65).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Wyon et al and Robinson et al by rotating the seed crystal, as taught by Li, to grow a crystal with a more uniform cross section.

Response to Arguments

7. Applicant's arguments filed 9/22/2005 have been fully considered but they are not persuasive.

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., relatively large boules, such as on the order of 2 inches in diameter (pg 7-8)) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the

specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). There are no size limitations claimed.

Applicant's argument that Grabmaier et al teachings indicates a polycrystalline boule and Grabmaier's teaching contradict applicant's teaching (pgs 7-8) is noted but is not found persuasive. Grabmaier et al clearly teaches the formation of single crystals (pg 356, col 2, lines 1-10). There is no evidence by applicant to contradict the teaching of the prior art. The prior art clearly discloses single crystal formation. This argument is viewed as mere attorney argument, which lacks evidence; therefore is not found persuasive. Likewise, Grabmaier teaches annealing is not required; therefore it would have been obvious to a person of ordinary skill in the art at the time of the invention that annealing is not required to produce single crystals.

Applicant's argument that Wyon does not teach the claimed stoichiometry is noted but is not found persuasive. Applicant's allege that Wyon teaches $Mg_{1-x}Ni_xAl_2O_4$, which would be a 1:1 ratio of Mg(Ni)O and Al_2O_3. This argument is not found persuasive because the presence of nickel necessarily requires the stoichiometric amount of MgO to be less than Al_2O_3. The claim merely recites aAD bE_2D_3, where A can be Mg, Ca, Zn, Mn, Ba, Sr, Cd, Fe and combinations thereof. It is noted nickel is not claimed as a possible component for A.

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Grabmaier et al ("Czochralski Growth of Magnesium-Aluminum Spinel") discloses growing stoichiometric Mg-Al spinel and a crystal with a molar ratio of Mg):Al_2O_3=1:3.2.

Grabmaier et al also discloses using a Czochralski method to grow the crystal, this reads on applicant's boule, using a seed crystal, a melt contained in an iridium crucible and a pulling rate of 0.5 cm/hr. Grabmaier et al also discloses the crystal could be sawed unannealed without cracking (pg 355-356), this reads on applicant's annealing time period not greater than 50 hours because the annealing time is 0.

Grabmaier (US 3,625,868) teaches forming a spinel monocrystal using a Czochralski process, note entire reference.

Maguire et al (US 4,347,210) teaches forming spinel single crystals using a Czochralski process or a flame fusion process.

Cullen et al (US 3,883,313) teaches forming a spinel single crystal with a non-stoichiometric composition (Abstract).

Wang et al (US 4,370,739) teaches forming a spinel single crystal boule by the Czochralski method and cutting the crystal to obtain wafers (col 4-5).

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37

CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J. Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Duane Smith can be reached on 571-272-1166. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Matthew J Song
Examiner
Art Unit 1722

MJS
December 8, 2005

ROBERT KUNEMUND
PRIMARY EXAMINER